bcc/enc: G. L. Love - DOE
C. C. Lushbaugh - ORAU
T. Shapiro

bcc: R. G. Jordan
K. W. Sommerfeld

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
P. O. BOX P, OAK RIDGE, TENNESSEE 37830

March 11, 1980

Dr. J. Stuart Warner, Vice President
INCO Limited
1 First Canadian Place
Toronto, Ontario M5X 1C4
Canada

Dear Stuart:

Enclosed is a copy of the protocol for the Oak Ridge welder study which I received recently from Dr. Polednak. His letter did not indicate whether he had sent a copy to you so, to be sure, I am sending you one together with a copy of his letter which may be of some interest to you.

Thanks for the information you have been passing on to us. We are following your efforts with OSHA with interest since, as you know, we use large amounts of nickel in our plants and overly restrictive regulations would make our work difficult and expensive.

Sincerely,

S. S. Stief

S. S. Stief

SSS:jc

Enclosures 2: Letter from Dr. Polednak dated February 28, 1980
Protocol for Welder Study

cc: File - SSS (NoRC)

STATE OF NEW YORK
DEPARTMENT OF HEALTH
OFFICE OF PUBLIC HEALTH

TOWER BUILDING • THE GOVERNOR NELSON A. ROCKEFELLER EMPIRE STATE PLAZA • ALBANY, N.Y. 12237

DAVID AXELROD, M.D.
Commissioner
ROGER C. HERDMAN, M.D.
Director of Public Health

BUREAU OF CANCER CONTROL
DWIGHT T. JANERICH, DDS MPH
Director

February 28, 1980

Mr. S.S. Stief
Environmental Coordinator
Oak Ridge Gaseous Diffusion Plant
Union Carbide Corporation
P.O. Box P
Oak Ridge, Tennessee 37830

Dear Stan:

Thank you for recent letter and copies of material from J. Stuart Warner. Enclosed is a copy of a protocol for the welder study requested by Dr. Warner.

The preliminary report on the welder study is not yet complete, due to the need for another computer run (by Howard Fore's group) in which K-25 welders are identified more precisely. Length of employment in welding has been calculated, and mortality will be analyzed in a subgroup who worked for one year or longer as welders at K-25.

It would be useful to have a very general description of the types of welding done and materials welded at the other plants (X-10 and Y-12). Perhaps you could obtain such information, so that a few sentences could be added to the report.

I shall keep you informed on progress in this study.

Sincerely,

Tony Polednak

Anthony P. Polednak, Ph.D.
Director, Epidemiology
and Population Genetics

APP/vf
Enclosure

Mortality Among Welders, Including A Group Exposed To Nickel Compounds

A.P. Polednak, Ph.D.

I. Background and Objectives

According to the NIOSH criteria document on inorganic nickel, epidemiologic studies are needed to determine the risk of developing nickel-related cancers in occupational groups which have not been adequately studied, such as welders (NIOSH, 1977, p. 17)

The objective of this study is to examine mortality from various diseases, especially cancers of the respiratory system, in a cohort of welders exposed to nickel compounds. This group is part of a larger cohort of welders under study. Since all welders are exposed to a variety of compounds (dusts, fumes and gases), another objective of the study is to contribute to knowledge of the long-term health effects of exposure to these compounds among welders.

II. Study Design

All white male welders who worked at Oak Ridge nuclear facilities from 1943 to 1977 were identified. One subgroup worked at a facility in which nickel-alloy pipes were welded, while the other subgroup worked at one or both of two other facilities.

Limitations of the study design mainly concern: (1)sample sizes and resultant sizes of confidence intervals; (2)length of follow-up relevant to assessment of specific outcomes (e.g., lung and sinonasal cancer); (3)paucity of exposure data (levels of nickel). These limitations are discussed further below.

III. Study Subjects

Welders were defined by use of existing record systems, including work histories or payroll records which specify job titles and job codes indicative of welding and more detailed "welding qualification" which indicate the types

Study Subjects cont.

of materials (metals) and procedure employed.

After exclusion of female and non-white welders, due to small numbers, the sample size was 1340.

In a preliminary analysis of mortality, follow-up was terminated on Jan. 1, 1974. Thus, welders hired after 1973 were excluded. In a subsequent analysis, follow-up will be terminated in 1978.

IV Comparison Subjects

Internal and external comparison groups are used. For internal comparisons, welders exposed to nickel compounds (i.e., employed in welding of nickel-alloy pipes)are compared with other welders in the study group. Standardized mortality ratios (SMR's) are calculated for each of the two groups for various causes of death, using U.S. white male death rates specific for age and time (Monson, 1974). The distributions of year of hire and age at hire (as welder) are similar in the two groups, but some adjustment may be necessary in comparing SMR's for the two groups for a given cause.

The mortality experience of the entire cohort of welders is also evaluated in a similar manner.

Further subdivisions are based on length of employment as a welder at all facilities and at the facility where nickel exposure is involved.

A major limitation of these comparisons is the small sample sizes, resulting in wide confidence limits on the SMR's (e.g., 200-300 for upper limits on the 95% interval for lung cancer in preliminary analyses).

As noted above, SMR's among the internal comparison groups will not be comparable due to small differences in age distributions. For this study another comparison group will eventually be developed as part of other ongoing studies in Oak Ridge, which will include all white male workers at the same plant that employs the nickel-exposed welders. Death rates for

Comparison subjects cont.

selected causes in this group (perhaps about 30,000 in number), possibly for all cancers and for lung cancer in broad age and calendar time intervals, will be used instead of U.S. male death rates to obtain expected numbers of deaths in the nickel-exposed welder cohort.

V. Data Collection Procedures

(1) a. Classification of subjects as welders.

The accuracy of work histories and job titles was checked by several methods; industrial hygienists at the plants were consulted to avoid possible exclusion of job titles and job codes associated with welding (on a full-time basis). Additional checks were made on a sample basis, using "welder qualification" documents.

The list of welders thus obtained was checked for accuracy by examination of medical records--for job titles, as well as demographic and medical data (discussed below).

b. Identification of nickel-exposed welders.

Records indicated that virtually all welders at one plant were "qualified" to weld nickel-alloy pipes. These pipes are a major constituent of the plant, where uranium (UF_6 gas) is enriched by a gaseous diffusion process.

One crude index of exposure is length of employment as a welder at the plant. Industrial hygiene data include air monitoring results for nickel in welding areas and by welding procedure and limited bioassay data (urinary nickel levels), which are available for recent years and may provide a lower limit of estimation for levels in earlier years. Nickel air levels may be compared with current or proposed standards. These data are in the final stages of preparation for inclusion in the preliminary report.

(2) Follow-up (mortality).

The main method of follow-up is through searches conducted by the the Social Security Administration (SSA); two searches have been conducted (i.e., in 1974 and in 1979). The completeness of follow-up by this method has been reported as about 90-95% in several studies of male occupational cohorts. Assessment of completeness of follow-up is possible by using several data sources. First, SSA reports individuals whose vital status is unknown (vs. those known alive, on the basis of an earnings or disability record). Second, other follow-up methods may be used for the "status unknown" group; state indexes of death are available for several states (in which the majority of the known deaths have occurred) and these are being used.

Incomplete follow-up, even if roughly equal in magnitude in the subgroups compared using SMR's, may obscure real differences; however, the magnitude of incompleteness is small and can be "corrected" under certain assumptions. Cause-specific SMR's may be adjusted for the (estimated) percentage of unascertained deaths, and for missing death certificates among known deaths.

Length of follow-up is an important consideration for certain outcomes of interest (i.e., cancers). In the present group, about half (53%) of all welders were hired in 1940-49 and now have 28 or more years of follow-up.

(3) Data collection.

Collection of most of the data has been supervised by the principal investigator. Relevant work history data has been obtained for checking the validity of classification of groups, as noted above. Industrial hygienists have collected other data and evaluated their uncertainties.

Death certificate data are coded by an experienced nosologist.

VI. Analytic Methods and Statistical Procedures

Mortality analysis is by standard modified life-table methods. For calculation of SMR's, expected numbers are obtained by multiplying the person-years of observation (in five-year-age and calendar-year intervals from year of first employment as a welder to year of death or the end of follow-up by average annual death rates for U.S. white males specific for age and calendar year (five-year intervals-Monson, 1974). Ninety-five percent confidence intervals are calculated under the Poisson assumption (Haenszel et al, 1962) and by other methods (i.e., the "jacknife") for selected cause-of-death categories. It is recognized that U.S. death rates may not be appropriate for certain cancer sites in a cohort comprised mainly of residents of Tennessee and other southern states. For lung cancer, however, the age-standardized mortality rate for white males in 1950-69 for Tennessee divided by the rate for the U.S. (Mason and McKay, 1974) was 0.88; also, not all men in the cohort were born (and/or died) in Tennessee.

As noted above, SMR's will be compared across various subgroups.

Causes of death are obtained from death certificated; the limitations of death certificate data are well known and must be considered in the interpretation of findings.

Several potential confounding factors are recognized. Age is taken into account in all analyses of this group of white males. Data on cigarette smoking habits (20 + cigarettes per day) has been obtained from medical records, but as in other studies such data are not available for early (pre-1958) workers; at one plant which operated from 1943 to 1947, however, the medical history included a question on "tobacco use." These data on smoking habits may be compared with U.S. survey data, and the subgroups may also be compared. Exposure to other toxic agents must also be considered; air monitoring and

Analytic Methods cont.

bioassay data on fluoride and uranium have been summarized for workers at the plant. External radiation levels have been very low, based on film-badge readings, at the gaseous diffusion plant where nickel-alloy pipes are welded. Recent bioassay data on barious metals are also available.

Type II statistical errors were not considered in the design of this study. Type I errors will be treated by use of confidence intervals (95% interval), as noted above.

VII. Interpretation, Limitations and Inferences.

The results will be discussed with reference to the limitations of the study-- e.g., sample sizes and confidence intervals, adequacy of data on nickel exposure or indirect indices of such exposure (i.e., length of follow-up.

The results will be interpreted in light of the findings of human studies and animal experiments dealing with similar toxic agents (especially metallic nickel and nickel compounds). The results of a few other recent studies on mortality among welders will be examined.

References

Haenszel, W., Loveland, D.B., and Sirken, M.G. 1962 Lung cancer mortality as related to residence and smoking histories. I.White males. J. Natl. Cancer INst. 28:947-1001.

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